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(54) Bicycle computer

(57) A bicycle cycle computer includes a main unit having a primary microprocessor, a display and three contacts; a plurality of sensors; and a secondary microprocessor provided on the bicycle and connected between the plurality of sensors and the main unit, for receiving parallel signals outputted from the plurality of sensors, the secondary microprocessor converting the received parallel signals into a serial signal and generating a synchronous clock signal, which are transmitted to the main unit through two of the contacts of the main unit, processed by the primary microprocessor and displayed on the display.

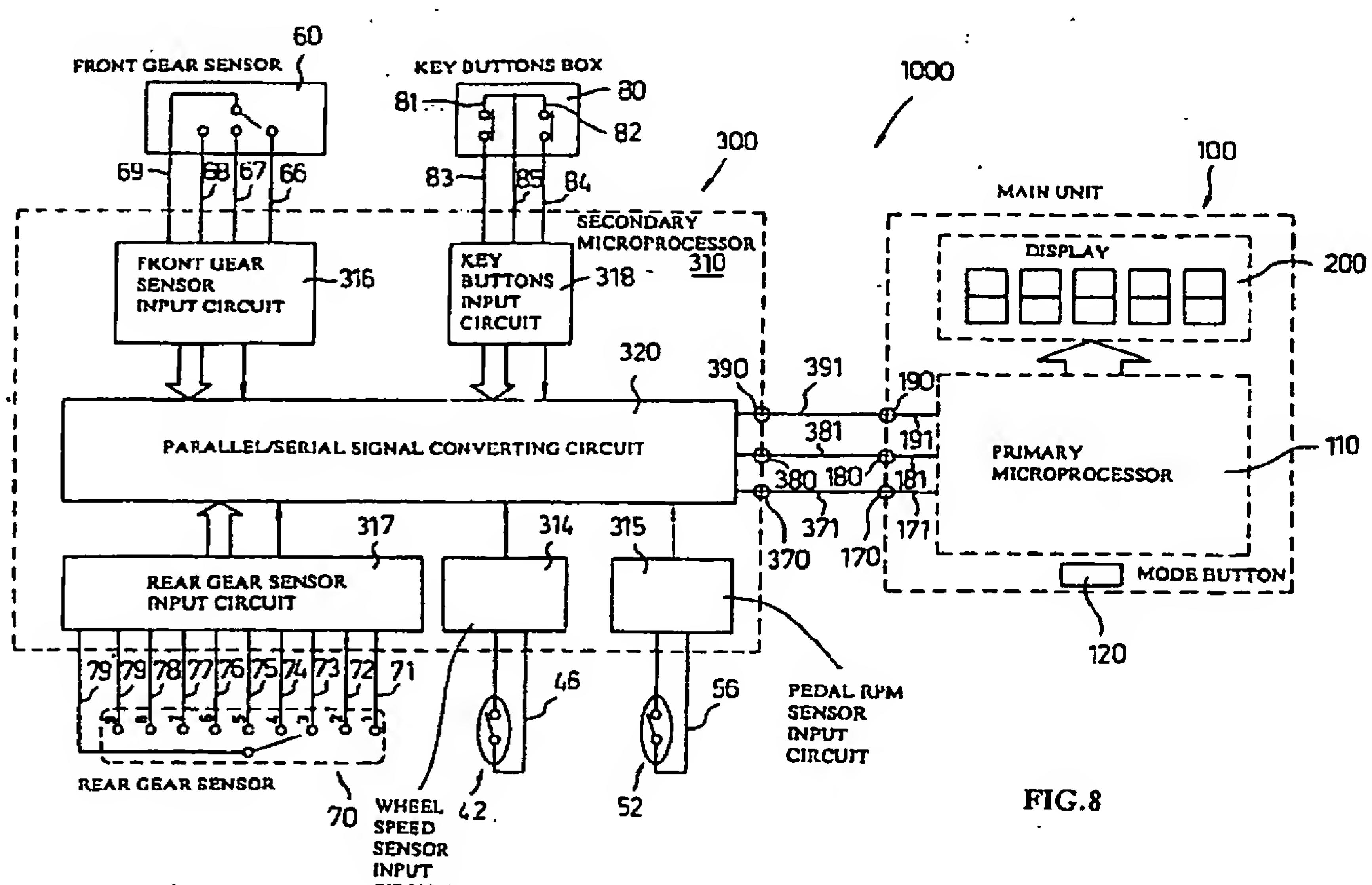

FIG.8

EP 0 887 251 A1

Description

BACKGROUND OF THE INVENTION

The present invention relates to a bicycle cycle computer for displaying various kinds of information regarding the speed, the pedal revolution per minute (rpm), the gear in operation, the pulse of the rider, the ambient temperature, the geographical height and the like.

Generally speaking, since a bicycle cycle computer is mounted on a bicycle and mainly used outdoors, it is required to be not only compact but also waterproof, shockproof and weatherproof. As shown in Figure 1, a conventional, commercially available bicycle cycle computer comprises a main unit 10, and a display 20 for displaying data, such as the speed, the distance traveled, the time and the pedal rpm, is provided on the front surface of the main unit 10. A mode button 12 for selecting different displaying modes is provided below the display 20. Figure 2 shows the back of the main unit 10. In Figure 2, reference numeral 13 denotes a battery cap for covering a battery accommodating chamber, 14 denotes a set button for switching among different data setting modes, 15 and 16 denote metal contacts for transmitting respective signals representing the detected speed and the detected pedal rpm (which will be described later) to a microprocessor (not shown) installed inside the main unit 10, and 17 denotes a metal contact as a common ground.

In addition, in order to prevent the main unit 10 from being stolen, the main unit 10 is preferably made to be detachable from the bicycle and portable. For this purpose, a conventional cycle computer is usually equipped with a bracket 30, as shown in Figure 3, which is mounted on a handlebar 90 of a bicycle by means of a screw 31. The main unit 10 can be inserted in the direction indicated by the arrow A as shown in Figure 3 so as to be detachably mounted onto the bracket 30. Thus, the rider can easily remove the main unit 10 from the bracket 30 whenever the bicycle is not in use, and mount the main unit 10 again later.

Figure 4 shows the connection between the bracket 30 as shown in Figure 3 and two sensors 42 and 52 via cables 46 and 56. Figure 5 shows the position relationship between a magnet 44 mounted on one spoke 92 of the front wheel and the sensor 42 of Figure 4 mounted on the inside of the fork 94, facing the magnet 44, and Figure 6 shows the position relationship between a magnet 54 mounted on the inside of the crank 95 and the sensor 52 of Figure 4 mounted on the chain stay 96, facing the magnet 54.

Among various data which can be displayed on the display 20 of the main unit 10, except the time data which is provided by a clock circuit built in the main unit 10, all the other data including the speed, the distance, the pedal rpm, etc., are obtained from signals supplied by the sensors 42 and 52 mounted on the fork 94 and the chain stay 96, respectively. The sensors 42 and 52 detect the numbers of rotation of the front wheel and the pedal crank 95 by sensing the associated magnets 44 and 54. The sensors 42 and 52 transmit thus detected signals via the cables 46 and 56 to the bracket 30. The signals are then transmitted to the microprocessor (not shown) in the main unit 10 through metal contacts 35 and 36 provided on the bracket 30 which are in electrical connection with the contacts 15 and 16 on the back of the main unit 10 when the main unit 10 is mounted on the bracket 30. The microprocessor performs, for example, identification, counting and calculation, on the supplied wheel rpm and pedal rpm data, and the processed data are then displayed on the display 20.

For example, the microprocessor of the main unit 10 calculates the speed by multiplying the wheel rpm with the circumferential length of the front wheel and calculates the distance traveled based on the calculated speed. In addition, the current pedal rpm or the average pedal rpm can be displayed to facilitate the rider's adjustment.

Therefore, as far as the main unit 10 of a cycle computer having two sensors 42 and 52 as mentioned above is concerned, it is necessary to provide two contacts 15 and 16 for transmitting signals supplied from the two sensors, respectively, to the microprocessor in the main unit 10 and a contact 17 for a common ground. That is, it is necessary to provide at least three contacts on the back of the main unit. Each of these contacts 15, 16 and 17 has to be provided on the back of the main unit 10 with a waterproof arrangement in order to prevent water from leaking into the interior of the main unit 10 to thereby result in a short circuit phenomenon. A typical waterproof arrangement for the contact is shown in Figure 7. Holes 15a, 16a and 17a are provided at the bottom of a lower case 10a of the main unit 10. Waterproof O-rings 15b, 16b and 17b are disposed in the holes 15a, 16a and 17a, respectively. Contact pins 15c, 16c and 17c are inserted to pass through the respective O-rings and protrude from the respective holes. Springs 15d, 16d and 17d for biasing the respective contact pins 15c, 16c and 17c outwards are provided between the pins and the printed circuit board 102. It is apparent that the waterproof arrangement for the contact is relatively complicated and the manufacturing cost therefore is high.

Recently, following the development of the handle-bar-type gear shifting device and the electronic gear shifting device, there is a demand for a new generation cycle computer which in addition to display the aforementioned data concerning the speed, the distance, the time and the pedal rpm, is also capable of displaying data concerning the gear in operation, the torque exerted on the crank shaft, the ambient temperature, the geographical height and even the pulse of the rider. This means a significant increase in the number of the sensors and hence the metal contacts on the back of the main unit and the corresponding metal contacts on

the bracket. Due to the significantly increased number of the metal contacts, it is difficult to keep the main unit compact. In addition, it is necessary to provide a waterproof arrangement for each of the contacts, thereby resulting in a very complicated structure and an increased manufacturing cost.

SUMMARY OF THE INVENTION

In view of the aforementioned problem, it is therefore an object of the invention to provide a bicycle cycle computer which is capable of displaying more kinds of information when compared with conventional cycle computers without increasing the number of contacts on the main unit thereof.

In order to achieve the above object, according to the invention, there is provided a bicycle cycle computer comprising a main unit having a primary microprocessor, a display and three contacts; a bracket mounted on the bicycle and on which the main unit is detachably mounted; a plurality of sensors including a wheel speed sensor, a pedal rpm sensor, a front gear sensor and a rear gear sensor which are mounted on the bicycle and sensors which are attached to a rider's body, for detecting various physiological conditions of the rider; and a secondary microprocessor provided on the bracket and connected between the plurality of sensors and the main unit, for receiving parallel signals outputted from the plurality of sensors, said secondary microprocessor converting the received parallel signals into a serial signal and generating a synchronous clock signal, which are transmitted to the main unit through two of the contacts of the main unit, processed by the primary microprocessor and displayed on the display.

The object of the invention can also be achieved by providing a bicycle cycle computer comprising a main unit having a primary microprocessor, a display and three contacts; a plurality of sensors including a wheel speed sensor, a pedal rpm sensor, a front gear sensor and a rear gear sensor which are mounted on the bicycle and sensors which are attached to a rider's body, for detecting various physiological conditions of the rider; and a secondary microprocessor provided on the bicycle and connected between the plurality of sensors and the main unit, for receiving parallel signals outputted from the plurality of sensors, the secondary microprocessor converting the received parallel signals into a serial signal and generating a synchronous clock signal, which are transmitted to the main unit through two of the contacts of the main unit, processed by the primary microprocessor and displayed on the display.

The object of the invention can also be achieved by providing a bicycle cycle computer comprising a main unit having a primary microprocessor, a display and three contacts; a bracket mounted on the bicycle and on which the main unit is detachably mounted; a plurality of sensors including a wheel speed sensor, a pedal rpm sensor, a front gear sensor and a rear gear sensor which are mounted on the bicycle and sensors which are attached to a rider's body, for detecting various physiological conditions of the rider; and a secondary microprocessor provided on the bracket and connected between the plurality of sensors and the main unit, for receiving parallel signals outputted from the plurality of sensors, the secondary microprocessor converting the received parallel signals into a serial signal and generating a synchronous clock signal, which are transmitted to the main unit through two of the contacts of the main unit, processed by the primary microprocessor and displayed on the display, wherein the primary microprocessor outputs a control signal based on the serial signal and the control signal is transmitted to an electronic automatic gear shifting device for performing gear shifting through the secondary microprocessor, the serial signal and the control signal being transmitted between the primary and the secondary microprocessors through the same contact.

The object of the invention can also be achieved by providing a bicycle cycle computer comprising a main unit having a primary microprocessor, a display and three contacts; a plurality of sensors including a wheel speed sensor, a pedal rpm sensor, a front gear sensor and a rear gear sensor which are mounted on the bicycle and sensors which are attached to a rider's body, for detecting various physiological conditions of the rider; and a secondary microprocessor provided on the bicycle and connected between the plurality of sensors and the main unit, for receiving parallel signals outputted from the plurality of sensors, the secondary microprocessor converting the received parallel signals into a serial signal and generating a synchronous clock signal, which are transmitted to the main unit through two of the contacts of the main unit, processed by the primary microprocessor and displayed on the display, wherein the primary microprocessor outputs a control signal based on the serial signal and the control signal is transmitted to an electronic automatic gear shifting device for performing gear shifting through the secondary processor, the serial signal and the control signal being transmitted between the primary and the secondary microprocessors through the same contact.

Preferably, a separated key buttons box is further provided on a handlebar of the bicycle and connected to the secondary microprocessor, for remotely controlling the main unit, so that the rider can select the displaying mode without moving his hands away from the handlebar.

Preferably, the display of the main unit displays one or simultaneously more of the speed, the pedal rpm, the gear in operation, the time, the mileage and the physiological condition of the rider.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a front view showing a main unit of a conventional bicycle cycle computer;

Figure 2 is rear view showing the main unit of the conventional cycle computer of Figure 1;

Figure 3 is a side view showing the state of the main unit of Figure 1 mounted on a bracket;

Figure 4 is a perspective view showing the connection between the bracket of Figure 3 and two sensors;

Figure 5 is a side view showing the mounting manner of a wheel speed sensor and a wheel magnet;

Figure 6 is a perspective view showing the mounting manner of a pedal rpm sensor and a pedal magnet;

Figure 7 is a sectional view showing water-sealed arrangements for metal contacts of the main unit;

Figure 8 is a block diagram showing a bicycle cycle computer according to a first embodiment of the invention;

Figure 9 is a wave form diagram showing a serial data signal and a synchronous clock signal;

Figure 10 is a block diagram showing a cycle computer according to a second embodiment of the invention;

Figure 11 is a block diagram showing a cycle computer according to a third embodiment of the invention; and

Figure 12 is a block diagram showing a cycle computer according to a fourth embodiment of the invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Figure 8 is a block diagram showing a cycle computer according to a first embodiment of the invention. As shown in Figure 8, a cycle computer 1000 comprises a main unit 100 and a bracket 300. The main unit 100 is detachably mounted on the bracket 300 as described above in reference to Figure 3. Similar to the conventional main unit 10 shown in Figures 1 and 2, the main unit 100 is provided with a primary microprocessor 110 and a display 200 for displaying various data processed by and supplied from the primary microprocessor 110. In addition, a mode button 120 for selecting different displaying modes is provided on the front surface of the main unit 100. Three metal contacts 170, 180 and 190 which are connected to the primary microprocessor 110 via signal transmission lines 171, 181 and 191, respectively, are provided on the back of the main unit 100. The contact 170 serves as a ground terminal, while the contact 180 is an input terminal for receiving a synchronous clock signal and the contact 190 is an input terminal for receiving a serial data signal (described in detail later). A waterproof arrangement as shown in Figure 7 is provided for each of the contacts 170, 180 and 190.

The shape of the bracket 300 is substantially the same as that of the conventional bracket 30 as shown in Figures 3 and 4. However, according to the invention, a secondary microprocessor 310 is built in the bracket 300. Three metal contacts 370, 380 and 390 are provided on the surface of the bracket 300, and when the main unit 100 is mounted on the bracket 300, the contacts 170, 180 and 190 of the main unit 100 are brought into contact with the contacts 370, 380 and 390 of the bracket 300, respectively. The contacts 370, 380 and 390 are connected via signal transmission lines 371, 381 and 391 to three output terminals of a one-way parallel/serial signal converting circuit 320 (described in detail later) in the secondary microprocessor 310. The contact 370 serves as a ground terminal for the circuit 320. The contact 380 is used as a synchronous clock signal output terminal for the circuit 320 and the contact 390 is a serial data signal output terminal for the circuit 320.

As shown in Figure 8, in addition to the one-way parallel/serial signal converting circuit 320, the secondary microprocessor 310 further comprises a wheel speed sensor input circuit 314, a pedal rpm sensor input circuit 315, a front gear sensor input circuit 316, a rear gear sensor input circuit 317, and a key buttons input circuit 318. Output signals from these circuits 314, 315, 316, 317 and 318 are transmitted to the one-way parallel/serial signal converting circuit 320.

A wheel speed sensor 42 mounted as shown in Figure 5 is connected to the wheel speed sensor input circuit 314 via two signal transmission lines 46, and a pedal rpm sensor 52 mounted as shown in Figure 6 is connected to the pedal rpm sensor input circuit 315 via two signal transmission lines 56.

A front gear sensor 60 mounted near one end of the bicycle handlebar is a three-position rotary switch which is connected to the front gear sensor input circuit 316 via three signal transmission lines 66, 67 and 68 and a ground wire 69. The front gear sensor 60 is coupled to a front gear shifting device (not shown) in order to detect the front gear in operation and supply the detected signal to the circuit 316.

A rear gear sensor 70 mounted near the other end of the bicycle handlebar is a nine-position rotary switch which is connected to the rear gear sensor input circuit 317 via nine signal transmission lines 71 to 79 and a ground wire 79'. The rear gear sensor 70 is provided to detect the rear gear in operation and supply the detected signal to the circuit 317.

A key buttons box 80 provided near one end of the handlebar has two remote key buttons 81 and 82. The first key button 81 is provided for selecting the displaying mode of the display 200 and the second key button 82 is a start/stop key button for starting or stopping a function of the main unit 100. The key buttons box 80 is connected to the key buttons input circuit 318 via two lines 83 and 84 and a ground wire 85.

Next, the operation of the cycle computer comprising the above components will be described in the following.

When the main unit 100 is mounted on the bracket 300, the contacts 170, 180 and 190 on the back of the main unit 100 are brought into contact with the contacts

370, 380 and 390 on the bracket 300, respectively, thereby making the primary microprocessor 110 in the main unit 100 and the secondary microprocessor 310 built in the bracket 300 electrically connected.

When a rider is riding a bicycle equipped with the cycle computer according to the invention described above, a wheel speed signal detected by the wheel speed sensor 42 is transmitted to the wheel speed sensor input circuit 314 via lines 46 and then to the one-way parallel/serial signal converting circuit 320. Similarly, a pedal rpm signal detected by the pedal rpm sensor 52 is supplied to the pedal rpm sensor input circuit 315 via lines 56 and then to the one-way parallel/serial signal converting circuit 320.

In addition, a front gear shifting signal detected by the front gear sensor 60 coupled to the front gear shifting device is transmitted to the front gear sensor input circuit 316 and then to the converting circuit 320. Likewise, a rear gear shifting signal detected by the rear gear sensor 70 coupled to the rear gear shifting device is transmitted to the rear gear sensor input circuit 317 and then to the converting circuit 320.

A mode selecting signal is transmitted to the key buttons input circuit 318 and then to the converting circuit 320 if the key button 81 of the key buttons box 80 is pressed. On the other hand, if the key button 82 is pressed, a start/stop signal is outputted from the key buttons box 80 and transmitted to the key buttons input circuit 318 and then to the converting circuit 320.

Therefore, the one-way parallel/serial signal converting circuit 320 receives parallel input signals from the wheel speed sensor 42, the pedal rpm sensor 52, the front gear sensor 60, the rear gear sensor 70 and the key buttons box 80, and then converts the received parallel signals into a serial signal by means of parallel/serial signal conversion. The serial signal obtained after the conversion is transmitted from the secondary microprocessor 310 to the primary microprocessor 100 through the serial signal output terminal 390 of the former and the serial signal input terminal 190 of the later. At the same time, the one-way parallel/serial signal converting circuit 320 generates a synchronous clock signal which is transmitted to the primary microprocessor 100 through the synchronous clock signal output terminal 380 and the synchronous clock signal input terminal 180.

The signals transmitted from the converting circuit 320 of the secondary microprocessor 310 to the primary microprocessor 110 are shown in Figure 9. The serial signal comprises a set of data including, for example, BIT1 representing wheel speed data obtained from the wheel speed sensor 42, BIT2 representing pedal rpm data obtained from the pedal rpm sensor 52, BIT3 representing control data transmitted from the key buttons box 80, BIT4 representing front gear data obtained from the front gear sensor 60, BIT5 representing rear gear data obtained from the rear gear sensor 70, and so on.

The primary microprocessor 110 performs identification, counting, calculation and other processes on the received data as shown in Figure 9, and displays the processed data requested by the rider on the display 200 of the main unit 100. Two or more kinds of data can be displayed on the display 200 simultaneously.

Since the signals supplied from the sensors 42, 52, 60 and 70 and the key buttons box 80 are converted into a serial signal as shown in Figure 9 by the one-way parallel/serial signal converting circuit 320 in the secondary microprocessor 310 built in the bracket 300 before transmitted to the primary microprocessor 110 in the main unit 100, only three pairs of contacts are needed for the electrical connection between the bracket 300 and the main unit 100, that is, the pair of contacts 390 and 190 for transmitting the serial signal, the pair of contacts 380 and 180 for transmitting the synchronous clock signal, and the pair of contacts 370 and 170 for the ground wire. In other words, the main unit 100 is provided with only three contacts 170, 180 and 190. Therefore, the cycle computer according to the embodiment of the invention comprises more sensors and hence provides more data when compared with the conventional cycle computer without increasing the number of contacts on the back of the main unit. Consequently, the construction of the main unit remains compact and simple.

In addition, with the separated key buttons box provided near the handlebar of the bicycle and connected to the secondary microprocessor, the rider can select the displaying mode without moving his hands away from the handlebar.

Figure 10 is a block diagram showing a cycle computer according to a second embodiment of the invention. The cycle computer 1000A shown in Figure 10 is different from the cycle computer 1000 shown in Figure 8 in that the bracket 300 in which the secondary microprocessor 310 is built according to the first embodiment is omitted in the second embodiment. That is, in the second embodiment, the main unit 100 is directly mounted on the handlebar, and the secondary microprocessor 310 is built in a suitable part of the bicycle. The aforementioned sensors including the wheel speed sensor 42, the pedal rpm sensor 52, the front gear sensor 60 and the rear gear sensor 70 and the key buttons box 80 are connected with the secondary microprocessor 310 via respective signal transmission lines 46, 56, 66 to 69, 71 to 79' and 83 to 85 as described in the first embodiment. The secondary microprocessor 310 is then connected to the primary microprocessor 110 via three lines 371, 381 and 391. Similarly, signals as shown in Figure 9 are transmitted from a one-way parallel/serial signal converting circuit 320 in the secondary microprocessor 310 to the main unit 110 for processing and then the processed data are displayed on the display 200 based on the displaying mode selected by the rider.

Recently, electronic automatic gear shifting devices

have been developed. In such a device, a torque sensor is used to detect the torque exerted on the crank shaft and a microprocessor is used to determine whether the detected torque is higher than a predetermined value. If the detected torque is higher than the predetermined value, it indicates that the torque exerted on the crank shaft is too large, and hence a gearing-up is desired in order to reduce the load of the rider. Accordingly, a control signal for gearing-up is outputted from the microprocessor and transmitted to the electronic automatic gear shifting device for performing the gearing-up operation. On the other hand, if the detected torque is lower than the predetermined value, then a gearing-down is desired. Similarly, a control signal for gearing-down is transmitted from the microprocessor to the electronic automatic gear shifting device for performing the gearing-down operation.

The aforementioned electronic automatic gear shifting device has been practically used, and the microprocessor in such a device can be integrated with the primary microprocessor in the main unit of the cycle computer according to the invention.

Figure 11 is a block diagram showing a cycle computer according to a third embodiment of the invention In addition to the sensors described in the first embodiment, as shown in Figure 11, the cycle computer 1000B according to the third embodiment further comprises a torque sensor 150 for detecting the torque exerted on the crank shaft. The detected signal outputted from the torque sensor 150 is transmitted to a torque sensor input circuit 350 via lines 156, and then to a two-way parallel/serial signal converting circuit 330 in the secondary microprocessor 310 built in the bracket 300. The signal from the torque sensor 150 is converted together with signals from other sensors (42, 52, 60, 70) into a serial signal which is transmitted from the two-way parallel/serial signal converting circuit 330 to the primary microprocessor 110 in the main unit 100 through the serial signal output terminal 390. The primary microprocessor 110 determines whether the torque exerted on the crank shaft is higher or lower than a predetermined value based on the signal obtained from the torque sensor 150. If it is determined that the torque is higher than the predetermined value, then the torque exerted on the crank shaft is too large, and hence a gearing-up is desired. Accordingly, a control signal is outputted from the primary microprocessor 110 and transmitted to the secondary microprocessor 310 which then outputs a control signal OP for gearing-up to a gear shifting mechanism 450 of an electronic automatic gear shifting device 400 for performing the gearing-up operation through signal transmission lines 336 and 456. On the other hand, if the torque is lower than the predetermined value, it indicates that a gearing-down is desired. Therefore, the primary microprocessor 110 outputs a control signal for gearing-down which is then transmitted to the gear shifting mechanism 450 of the electronic automatic gear shifting device 400 for performing the gearing-down operation.

In this case, the control signals for gearing-up and gearing-down outputted from the primary microprocessor 110 are transmitted to the secondary microprocessor 310 via the existing lines 191 and 391 and the metal contacts 190 and 390.

The cycle computer 1000B according to the third embodiment of the invention can share the same microprocessor with an existing electronic automatic gear shifting device, thereby increasing the function of the cycle computer.

Figure 12 is a block diagram showing a cycle computer according to a fourth embodiment of the invention. The cycle computer 1000C shown in Figure 12 is different from the cycle computer 1000B shown in Figure 11 in that the bracket 300 is omitted. That is, in the fourth embodiment, the main unit 100 is directly mounted on the handlebar, and the secondary microprocessor 310 is built in a suitable part of the bicycle. The aforementioned sensors including the wheel speed sensor 42, the pedal rpm sensor 52, the front gear sensor 60, the rear gear sensor 70 and the torque sensor 150 and the key buttons box 80 are connected with the secondary microprocessor 310 via respective signal transmission lines 46, 56, 66 to 69, 71 to 79', 156 and 83 to 85 as described in the third embodiment. The secondary microprocessor 310 is then connected to the primary microprocessor 110 via three lines 371, 381 and 391, thereby achieving the same function as that described above in connection with the third embodiment.

Although in the four preferred embodiments described above, sensors for detecting the physiological conditions of the rider and sensors for detecting the ambient conditions such as the temperature and the pressure are not incorporated therein, the addition of these sensors and other sensors becomes apparent for those skilled in the same field in the light of the teaching disclosed above.

While the present invention has been described above in detail in connection with its preferred embodiments, it is to be understood that the present invention is not limited to the details of the illustrated embodiments, but may have various changes, modifications and improvements, which may occur to those skilled in the art, without departing from the spirit and the scope of the present invention.

Claims

1. A bicycle computer for a bicycle comprising:

   a first processing unit (310) structured for mounting to the bicycle;
   the first processing unit (310) being arranged for connection with a plurality of sensors (42, 52, 60, 70, 80) and for receiving sensor data in parallel format outputted from the sensors;
   wherein the first processing unit (310) receives

the sensor data in parallel format and outputs data corresponding to the sensor data in serial format.

2. A bicycle computer according to claim 1, further comprising:

   a main unit (100) for being detachably mounted to the bicycle, having a second processing unit (110) and a display (200);
   wherein the second processing unit (110) receives the serial data outputted from the first processing unit (310) and processes the serial data for displaying on the display (200).

3. A bicycle computer according to claim 2, further comprising a mounting bracket (300) for mounting on the bicycle on which bracket (300) the main unit (100) is detachably mounted.

4. A bicycle computer according to claim 3, wherein the first processing unit (310) is disposed within the mounting bracket (300).

5. A bicycle computer for a bicycle comprising:

   a mounting bracket (300) for mounting the computer to the bicycle, wherein the bracket (300) includes a first processing unit (310);
   a main unit housing including a second processing unit (110), wherein the main unit housing is detachably mounted to the bracket (300);
   a sensor (42, 52, 60, 70, 80) for providing sensor data to the first processing unit (310);
   wherein the first processing unit (310) receives the sensor data and outputs data corresponding to the sensor data to the second processing unit (110).

6. A bicycle computer according to one of claims 1 to 5, wherein the first processing (310) unit includes a command output terminal (336) for outputting a control command.

7. A bicycle computer according to claim 6, wherein the command output terminal is provided for controlling a gear shift mechanism (450).

8. A bicycle computer according to one of claims 2 to 7, wherein the first processing unit (310) communicates the sensor data in serial format to the second processing unit (110) via a first contact provided on the main unit (100).

9. A bicycle computer according to claim 8, wherein only a single first contact communicates the serial data from the first processing unit (310) to the second processing unit (110).

10. A bicycle computer according to claim 8 or 9 in combination with claim 6 or 7, wherein the second processing (110) unit communicates control information for outputting the control command via the first contact to the first processing unit (310).

11. A bicycle computer according to one of claims 2 to 10, wherein the first processing unit (310) generates a synchronous clock signal which is communicated to the second processing (110) unit via a second contact provided on the main unit.

12. A bicycle computer according to claim 11 wherein only a single second contact communicates the clock signal from the first processing unit to the second processing unit.

13. A bicycle computer according to one of claims 2 to 12, wherein a third contact is provided on the main unit (100) for communicating a ground signal from the first processing unit (310) to the second processing unit (110).

14. A bicycle computer according to one of claims 1 to 13, wherein the first processing unit (310) is arranged for connection with sensors which include a wheel speed sensor or/and a pedal rpm sensor or/and a front gear sensor or/and a rear gear sensor or/and at least a sensor which is attached to a rider's body for detecting various physiological conditions of the rider.

15. A bicycle computer for a bicycle comprising:

   a first processing (310) unit structured for mounting to the bicycle;
   a sensor (42, 52, 60, 70, 80) for providing sensor data to the first processing unit (310);
   wherein the first processing unit (310) receives the sensor data from the sensor and outputs data corresponding to the sensor data;
   a display (200);
   a second processing unit (110) for receiving the sensor data from the first processing unit (310) and for outputting display data to the display (200); and
   wherein exactly three communication paths communicate signals from the first processing unit (310) to the second processing unit (110).

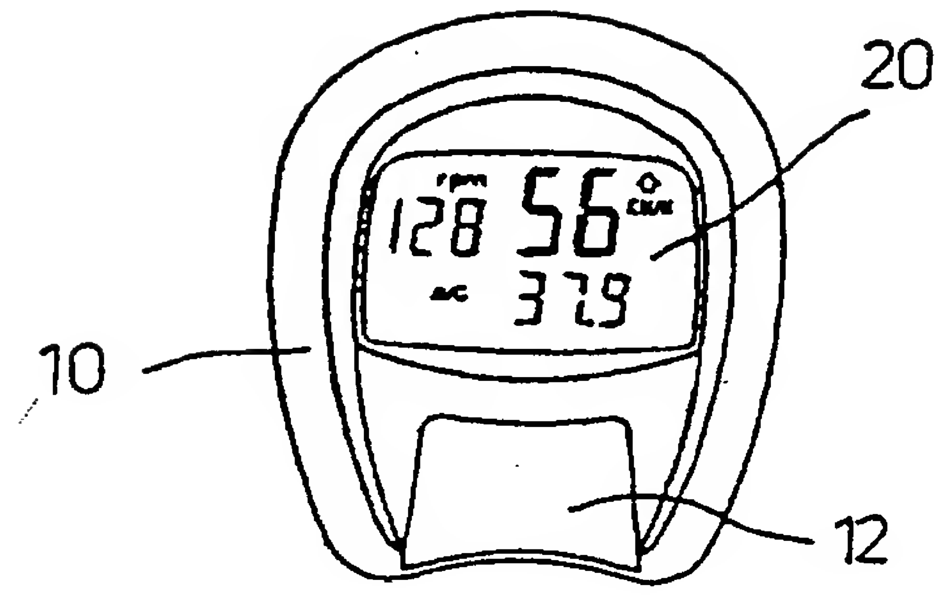

FIG.1

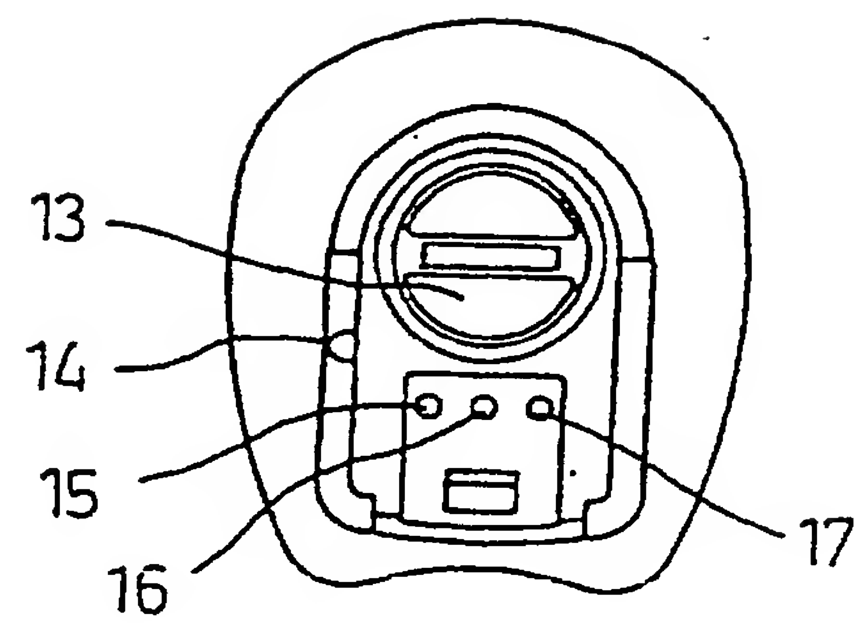

FIG.2

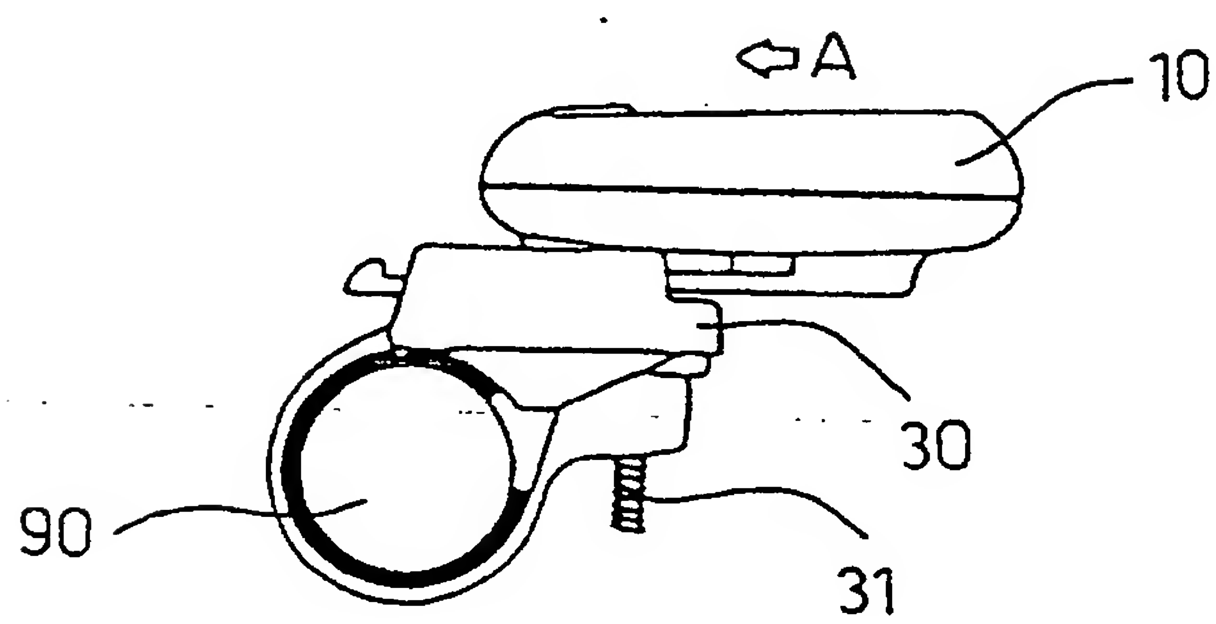

FIG.3

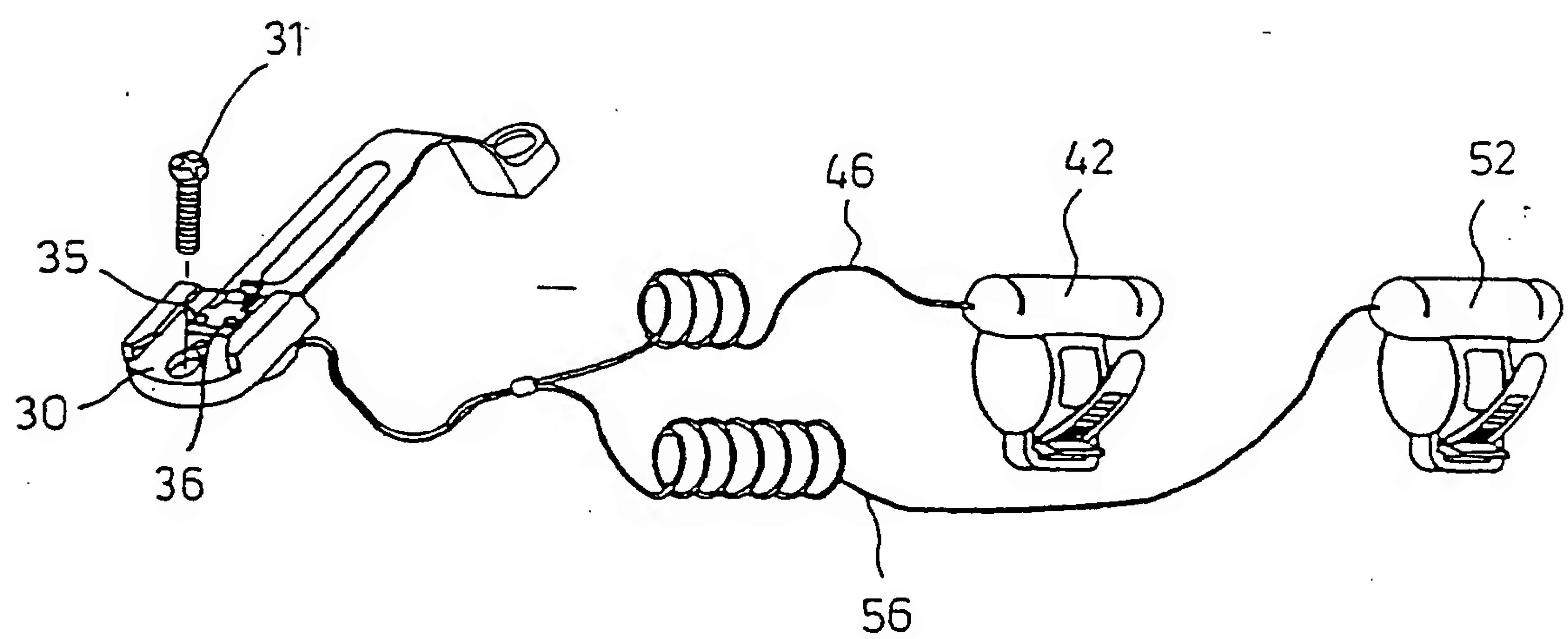

FIG.4

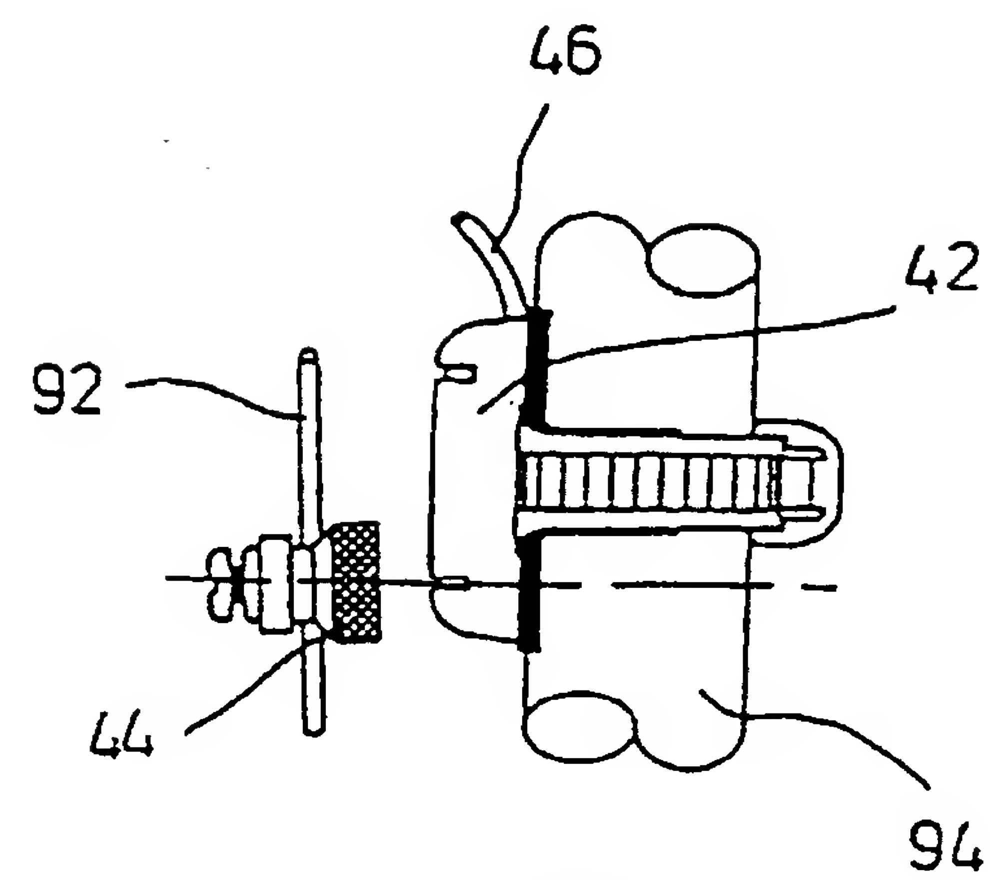

FIG.5

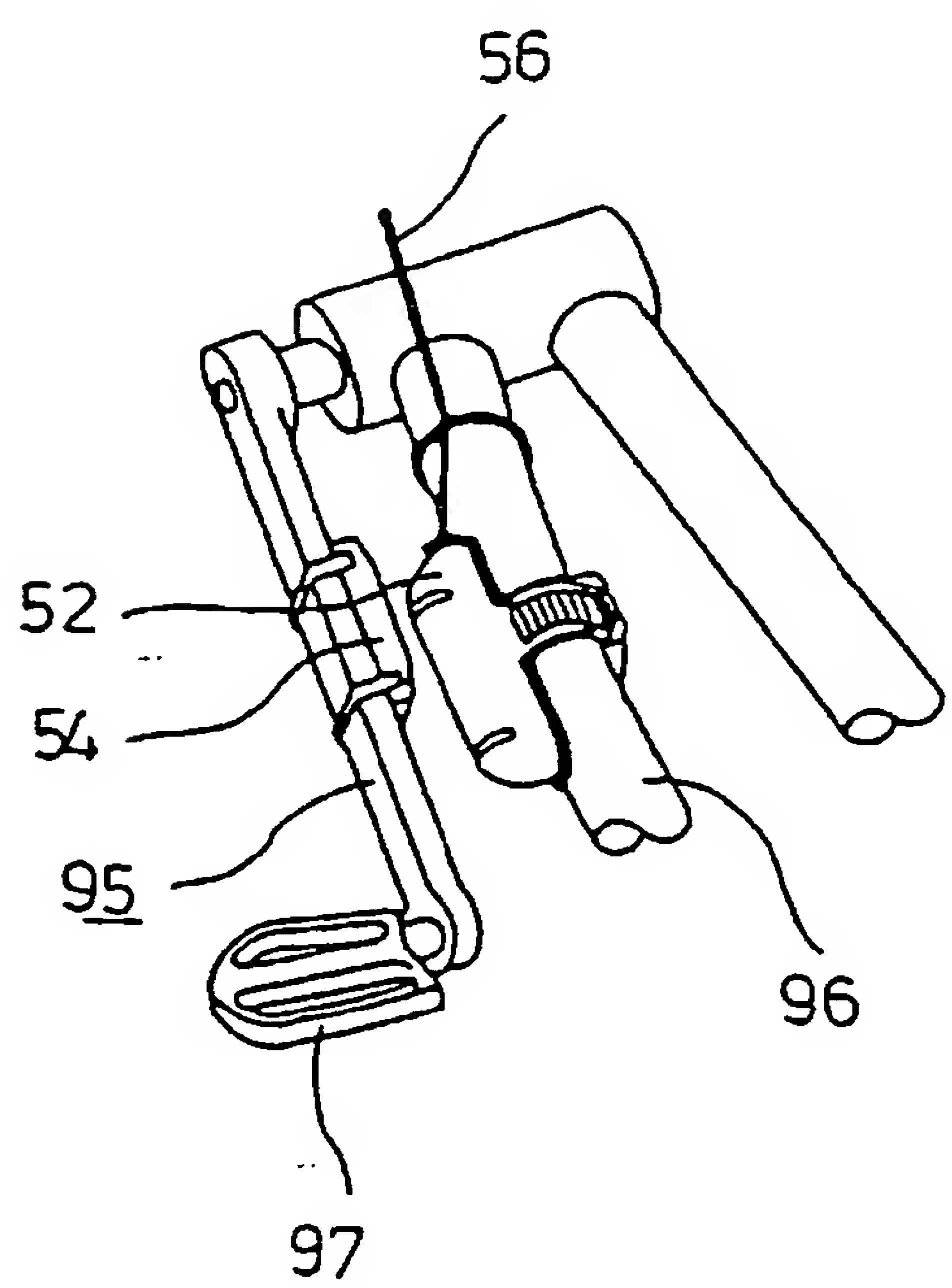

FIG.6

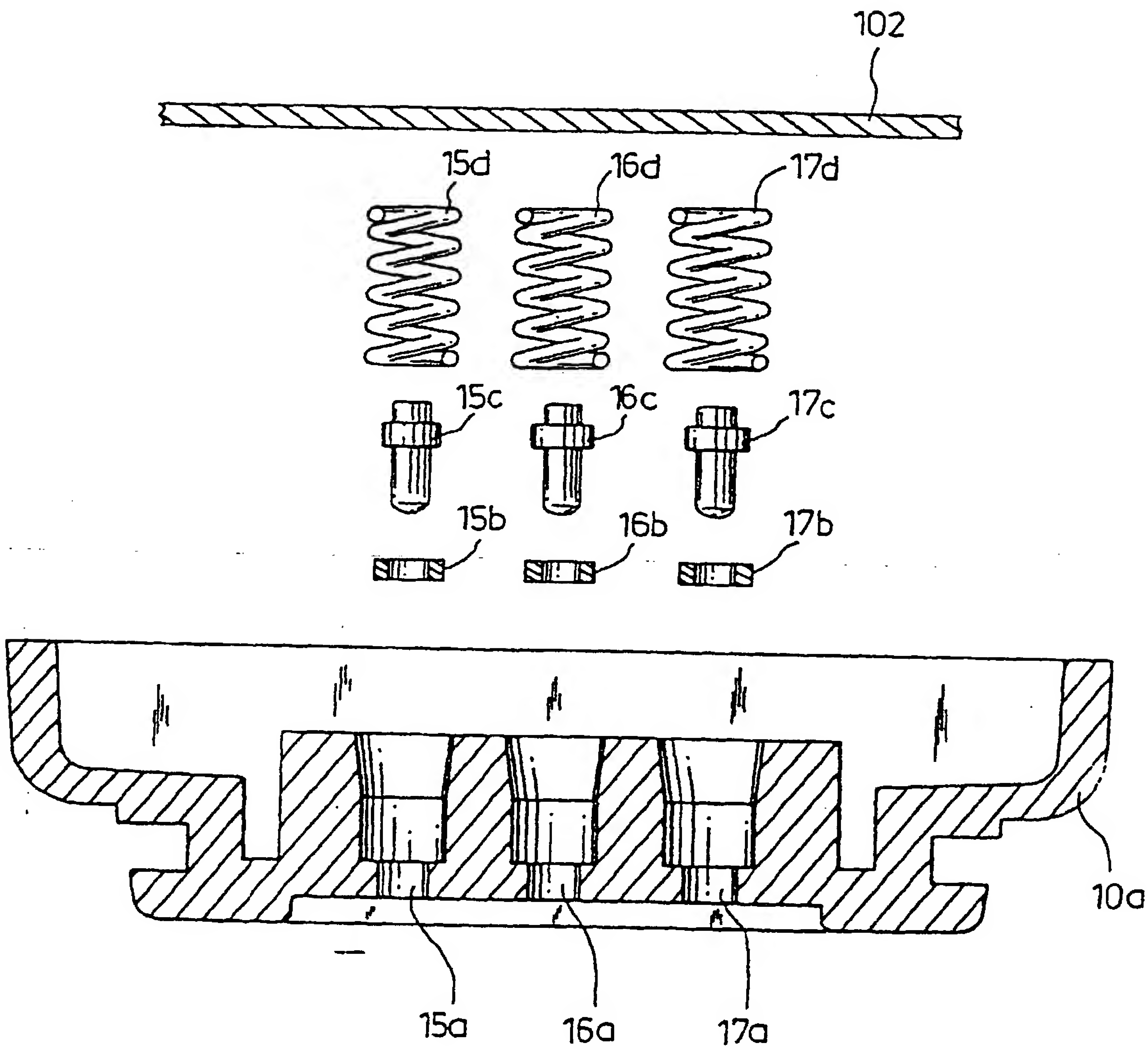

FIG.7

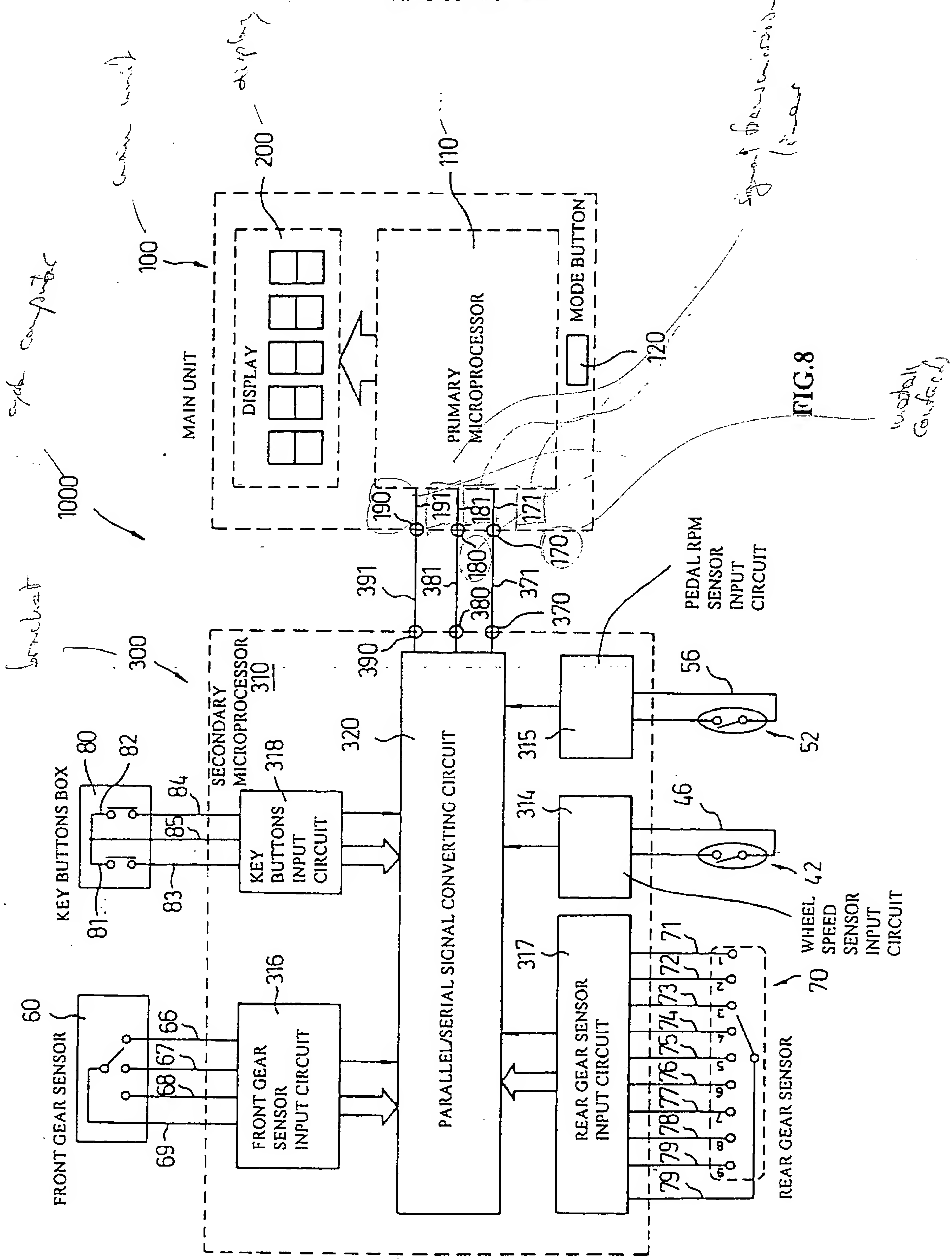
MAIN UNIT
DISPLAY
PRIMARY MICROPROCESSOR
MODE BUTTON
SECONDARY MICROPROCESSOR
310
KEY BUTTONS BOX
FRONT GEAR SENSOR
KEY BUTTONS INPUT CIRCUIT
FRONT GEAR SENSOR INPUT CIRCUIT
PARALLEL/SERIAL SIGNAL CONVERTING CIRCUIT
REAR GEAR SENSOR INPUT CIRCUIT
PEDAL RPM SENSOR INPUT CIRCUIT
WHEEL SPEED SENSOR INPUT CIRCUIT
REAR GEAR SENSOR
1000
100
200
110
120
190
191
181
171
170
180
391
381
371
390
380
370
300
320
315
314
317
318
316
80
81
82
83
84
85
60
66
67
68
69
56
52
46
42
70
71
72
73
74
75
76
77
78
79

FIG.8

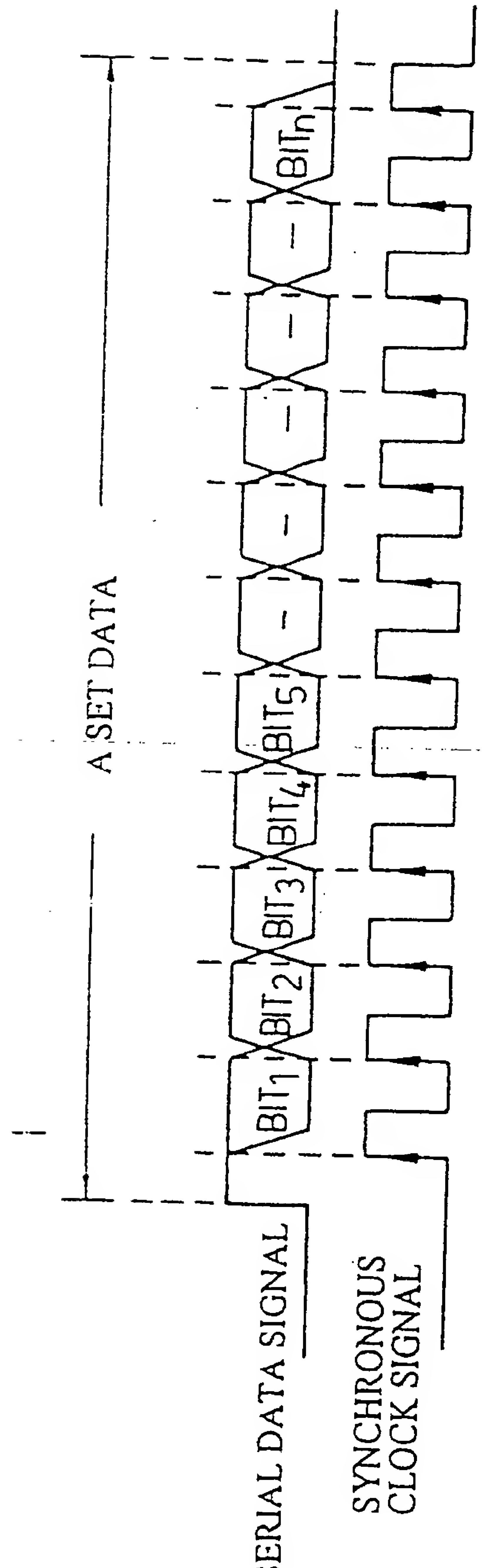
A SET DATA
BIT1
BIT2
BIT3
BIT4
BIT5
BITn
SERIAL DATA SIGNAL
SYNCHRONOUS
CLOCK SIGNAL

FIG.9

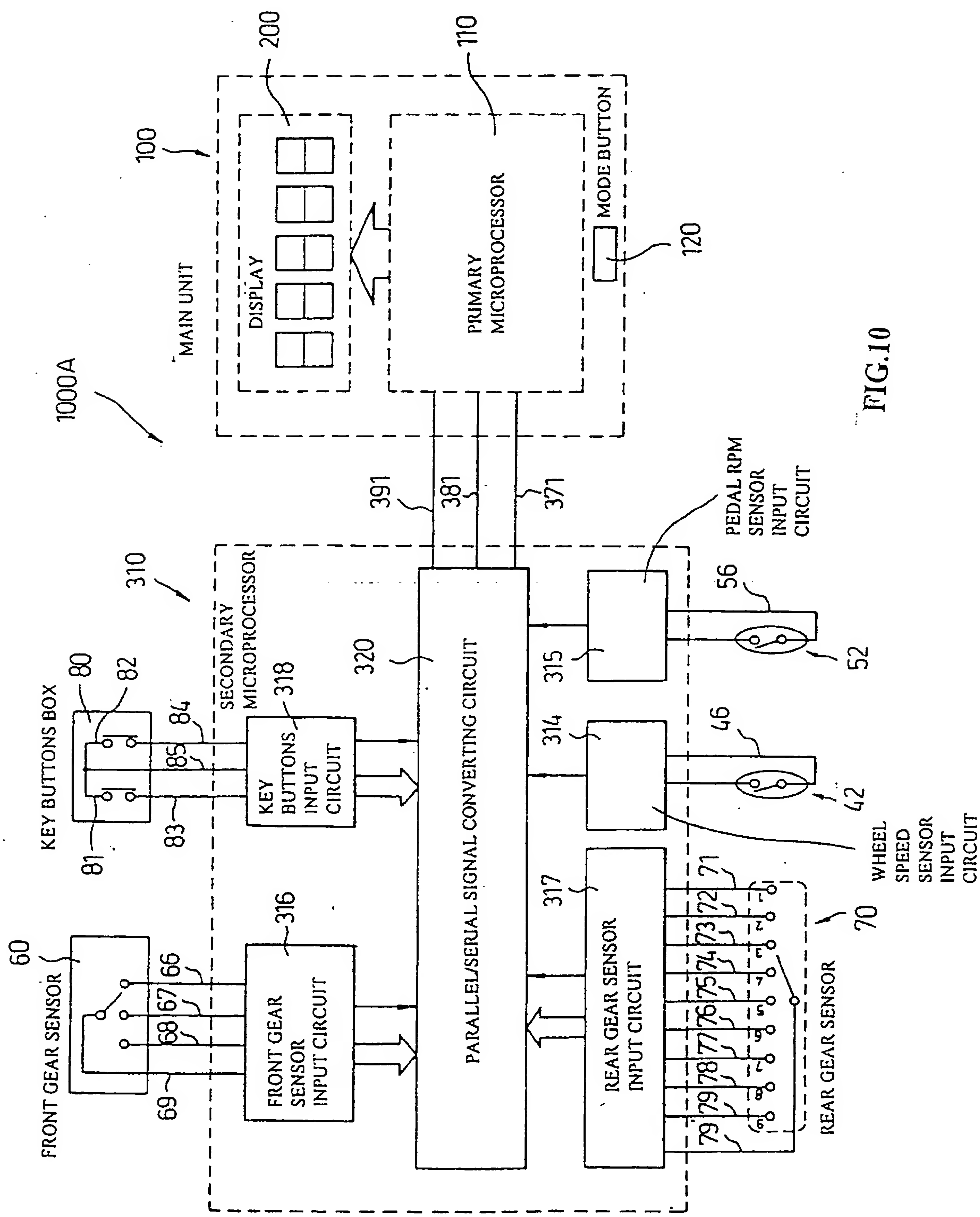
1000A
100
MAIN UNIT
DISPLAY
200
110
PRIMARY MICROPROCESSOR
MODE BUTTON
120
391
381
371
310
SECONDARY MICROPROCESSOR
320
PARALLEL/SERIAL SIGNAL CONVERTING CIRCUIT
KEY BUTTONS BOX
80
81
82
83
84
85
318
KEY BUTTONS INPUT CIRCUIT
FRONT GEAR SENSOR
60
66
67
68
69
316
FRONT GEAR SENSOR INPUT CIRCUIT
317
REAR GEAR SENSOR INPUT CIRCUIT
REAR GEAR SENSOR
70
71
72
73
74
75
76
77
78
79
314
315
46
42
56
52
PEDAL RPM SENSOR INPUT CIRCUIT
WHEEL SPEED SENSOR INPUT CIRCUIT

FIG.10

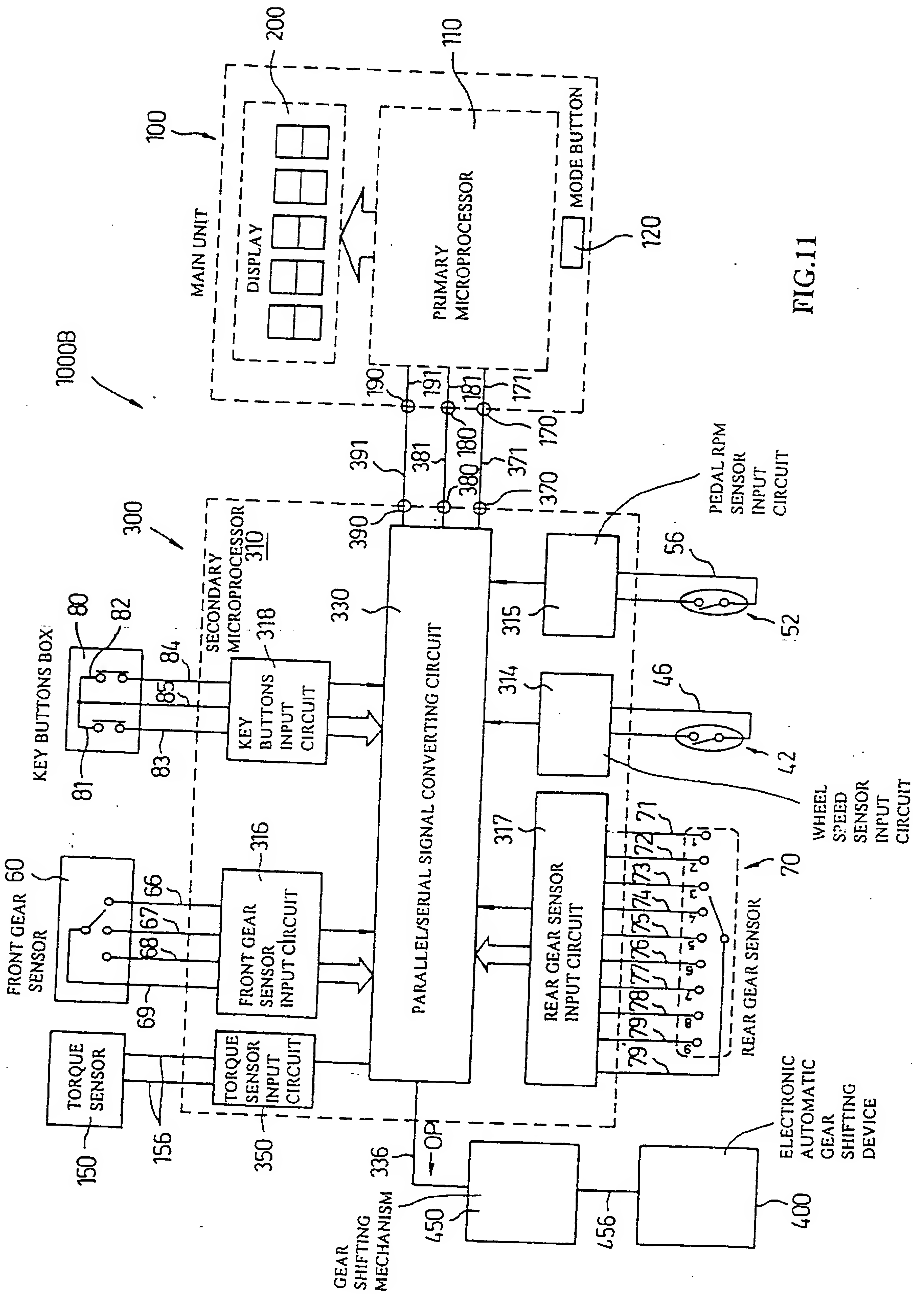
1000B
100
MAIN UNIT
DISPLAY
200
110
PRIMARY MICROPROCESSOR
MODE BUTTON
120
190
191
181
171
180
170
391
381
371
390
380
370
300
SECONDARY MICROPROCESSOR 310
KEY BUTTONS BOX
80
81
82
83
84
85
318
KEY BUTTONS INPUT CIRCUIT
330
PARALLEL/SERIAL SIGNAL CONVERTING CIRCUIT
315
314
317
PEDAL RPM SENSOR INPUT CIRCUIT
56
52
46
42
WHEEL SPEED SENSOR INPUT CIRCUIT
FRONT GEAR SENSOR
60
66
67
68
69
316
FRONT GEAR SENSOR INPUT CIRCUIT
REAR GEAR SENSOR INPUT CIRCUIT
REAR GEAR SENSOR
70
71
72
73
74
75
76
77
78
79
TORQUE SENSOR
150
156
TORQUE SENSOR INPUT CIRCUIT
350
336
OP
GEAR SHIFTING MECHANISM
450
456
ELECTRONIC AUTOMATIC GEAR SHIFTING DEVICE
400

FIG.11

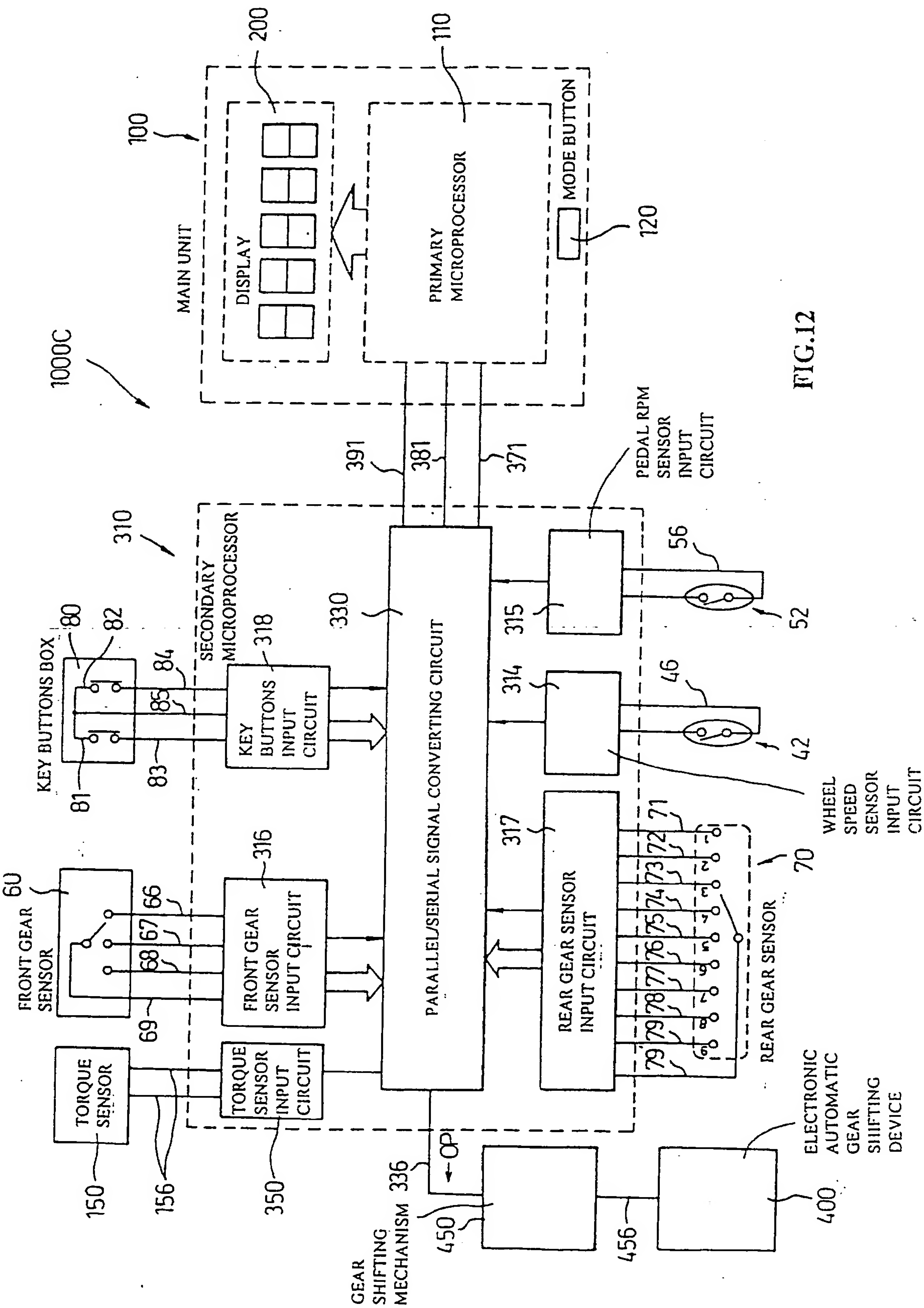
1000C
100
MAIN UNIT
DISPLAY
200
PRIMARY MICROPROCESSOR
110
MODE BUTTON
120
391
381
371
310
SECONDARY MICROPROCESSOR
330
PARALLEL/SERIAL SIGNAL CONVERTING CIRCUIT
315
314
317
318
KEY BUTTONS INPUT CIRCUIT
KEY BUTTONS BOX
80
81
82
83
84
85
60
FRONT GEAR SENSOR
66
67
68
69
316
FRONT GEAR SENSOR INPUT CIRCUIT
TORQUE SENSOR
150
156
TORQUE SENSOR INPUT CIRCUIT
350
REAR GEAR SENSOR INPUT CIRCUIT
REAR GEAR SENSOR
70
71
72
73
74
75
76
77
78
79
PEDAL RPM SENSOR INPUT CIRCUIT
56
52
46
42
WHEEL SPEED SENSOR INPUT CIRCUIT
OP
336
450
GEAR SHIFTING MECHANISM
456
400
ELECTRONIC AUTOMATIC GEAR SHIFTING DEVICE

FIG.12

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 11 1009

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Y	DE 296 04 853 U (PÖLLMANN) 23 May 1996 * page 1, line 1 - line 2 * * page 4, line 8 - line 35 *	1,5, 11-15	B62J39/00 G01D21/02 G01P1/00
Y	DE 34 45 617 A (MAX STEGMAN GMBH) 4 July 1985 * claim 1 * * page 11, line 23 - page 12, line 20 *	1,11-14	
Y	PATENT ABSTRACTS OF JAPAN vol. 7, no. 249 (P-234), 5 November 1983 & JP 58 132807 A (HINO JIDOSHA KOGYO KK), 8 August 1983 * abstract *	5,15	
A		2,8-10	
A	US 5 261 858 A (BROWNING) 16 November 1993 * abstract *	6,7	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)
B62J
G01D
G01P

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	22 September 1998	Lut, K

CATEGORY OF CITED DOCUMENTS

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& : member of the same patent family, corresponding document